

## What is cloning and what is gene splicing?

### ***Cloning***

A clone is a collection of individuals that are genetically identical, i.e. who have inherited exactly the same properties. A variety of apple, such as Granny Smith, is an example. All Granny Smith apples come from trees that form a clone. They all stem from grafting twigs from other Granny Smith trees. Way back they all originate from one single tree. Another example of clones is identical twins, triplets, quadruplets, and quintuplets. The Dionne quintuplets are a famous example.

Today the word **cloning** is used to describe the technique that brought forth Dolly the sheep. She was genetically (nearly) identical to her mother. Dolly was created by the following operations: an oocyte from a sheep got its nucleus removed and replaced with the nucleus of a cell from Dolly's mother. The nucleus contains all the chromosomes and virtually all inheritance, so the resulting cell essentially carried the inheritable properties of Dolly's mother. It was developed into the lamb Dolly in the uterus of a foster mother. Dolly and her mother form a clone. The same feat has been tried with several other mammals since. There has been some live animals born, but a vast majority of these embryos die before they are born.

An interesting variant of cloning is when the desired end product is not an animal but a cell culture. For this purpose the researchers start out as with Dolly, but then take cells from the early embryo and cultivate them in cell culture medium. With the appropriate procedures it has been possible to obtain cells that can develop into several different types of cells such as blood cells, muscle cells, and nerve cells. Hopefully this technique will be used for "**therapeutic cloning**", when enough knowledge has accumulated about how to instruct the cell culture cells to develop into precisely the desired type of cells. Ideally you take a nucleus from a patient and introduce it into an oocyte whose own nucleus has been removed. From that oocyte a cell culture is derived and finally induced to produce exactly the cell type that the patient needs. For a diabetes patient it would be insulin-producing cells. Those could then be introduced into the patient, where the immune system would treat them as cells coming from the patient. Unfortunately it will take time to solve all problems involved before this good idea can be realized.

### ***Gene splicing***

DNA is the genetic material. It contains the inherited instructions about how the individual should look and behave. It can be likened to a magnetic tape containing information. And just like you can cut and splice a sound tape or videotape you can cut and splice the DNA. This technique that can be called gene splicing has been enormously useful as a research tool. It has also had many industrial applications, e.g. in constructing a bacterium that produces human growth hormone or a yeast that produces human insulin